

Improved Tropical Cyclone Track and Intensity Forecasting

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Person(s) Visited

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- (e) Mr. Gordon Jackson, Senior Meteorologist, Tropical Analysis and Prognosis, Bureau of Meteorology, Casuarina Australia, Phone (618)8920-3836, FAX: (618)8920-3840 email g.jackson@bom.gov.au

LONG-TERM GOALS

Improved tropical cyclone track and intensity forecasting through development and use of dynamic ensemble model predictions that combine numerical model tropical cyclone track and intensity output from different global modeling centers.

OBJECTIVES

- 1) Develop automated data exchange between JTWC, and AUS for real-time dynamic model ensemble production.
- 2) Establish collaborative relationship for the development of JTWC and AUS tropical cyclone workstation software.
- 3) Develop collaborative links between US (JTWC/NRL/NPS) and AUS (BOM) for numerical tropical cyclone modeling improvements.

APPROACH

a) NRL Monterey, CA is the lead laboratory for the development of the Automated Tropical Cyclone Forecast (ATCF) workstation. A 13-year ATCF development effort has produced a pre-eminent tropical cyclone forecast workstation that is the mainstay of

the Joint Typhoon Warning Center operations. ATCF was recently adapted for use at the National Hurricane and Central Pacific Hurricane Centers. The ATCF installation at all the U.S. tropical cyclone forecast centers will allow for the real-time exchange of data and the improvement of forecast and customer support.

b) The Joint Typhoon Warning Center uses an ensemble of dynamic model vortex trackers as guidance in developing tropical cyclone track forecasts. When this simple ensemble consists of 4 or more dynamic models, the quality of the track predictions is improved by over 40 %. The number of U.S. models available for ensemble forecasts are limited due to the high cost of high-resolution numerical modeling. Thus, JTWC must utilize foreign resources to produce these high quality track predictions. The current ensemble model members in the NWPAC are the Navy Global Atmospheric Prediction System (NOGAPS), the Geophysical Fluid Dynamics Model-Navy (GFDN), the UK Met Office Model (EGRR), the Japanese Global Spectral Model (JGSM) and the Japanese Typhoon Model (JTYM).

c) In the Southern Hemisphere there are only three model members, NGPS, GFDN and EGRR. To expand the members in the Southern Hemisphere JTWC needs automated access to at least two more high quality TC forecast models. Studies with Northern and Southern Hemisphere Models indicate that increased ensemble model members has provided significant forecast improvement. The Bureau of Meteorology in Australia runs TC track predictions using the Tropical Cyclone Local Area Prediction System (TCLAPS) and the Tropical Local Area Prediction System (TLAPS) for numerical model predictions. Both of these models are highly respected and will improve the quality of the JTWC numerical ensemble in the Southern Hemisphere.

d) In the short term JTWC would like to receive TC vortex forecast position output from the TCLAPS and TLAPS. Access to the model fields is also necessary to allow the TC track forecasters to determine if model errors are present that would degrade the quality of the ensemble by inclusion of the vortex tracker output from the individual models.

e) In the long term, JTWC wishes to implement the use of standard system files at the BOM and JTWC to facilitate automated data exchange of all TC information between forecast workstations to minimize or eliminate the need to develop and maintain message decoders and format converters. Additionally, standard system files would enhance the ability to utilize new data sets. For example, the BOM has developed a three dimensional radar display capability that JTWC would like to incorporate into the ATCF

f) A software development meeting is needed to facilitate necessary forecast system modifications for the automated data exchange and enhancements to the ATCF and the Australian Tropical Cyclone Forecast Module. This meeting is scheduled for August 2001, at JTWC. Following this meeting, the BOM programmers will make the necessary modifications to their code to support the standardized data format and future data exchange.

TRAVEL COMPLETED

Table 1. Summary of visits conducted under this VSP

| Person Visited | Position | Institution/Conference | Location | Scientific/Technical Purpose | Dates (mm/dd/yy format) |
|--------------------|---|---------------------------------|---------------------|-------------------------------------|-------------------------|
| James Kelly | Supervising Meteorologist Regional Computing Section Melbourne Australia | HMAS Kuttabul | Sydney Australia | Standard Data File Agreement | 03/27/01 |
| CDR Craig Roy, RAN | Director of Oceanography & Meteorology | HMAS Kuttabul | Sydney Australia | Bilateral Data Exchange Agreement | 03/28/01 |
| Jim Davidson | Supervising Meteorologist | Queensland Weather Services | Brisbane | Meteorology Observation Data Access | 03/29-04/02/01 |
| Geoffrey Garden | Supervising Meteorologist | Darwin Regional Forecast Centre | Darwin Australia | Meteorology Data Access | 04/03/01 |
| Gordon Jackson | Senior Meteorologist | Tropical analysis and prognosis | Darwin Australia | Vortex Tracker Output | 01/03/01 |

RESULTS

Visit to HMAS Kuttabul: (a) International data exchange is possible under existing agreements between the RAN and the U.S. Navy. (b) The BOM TC forecast system developers are interested in using a standard TC data file format.

Visit to BOM Queensland: (a) JTWC was provided access to all TC observation data available to BOM Queensland via restricted website. (b) BOM Queensland supports all efforts to exchange TC forecast data and standard file formats.

Visit to Darwin RSMC: (a) JTWC was provided access to all TC observation data available to BOM Darwin via restricted website. (b) RSMC Darwin has added JTWC to the automated email distribution of all TCLAPS and TLAPS track predictions. (c) JTWC now has access to a secure ftp site to obtain TCLAPS and TLAPS grib data. (d) RSMC Darwin supports all efforts to exchange TC forecast data and standard file formats.

IMPACT APPLICATIONS

- a) Access to all observation data is necessary to properly introduce synthetic observations into numerical models to improve tropical cyclone track predictions.
- b) The use of the TCLAPS and TLAPS track forecast data in the JTWC ensemble predictions is expected to improve the ensemble prediction by 25 to 40 %.

TRANSITIONS

- a) The JTWC forecaster workstation (ATCF) has been modified to include the TCLAPS and TLAPS tracks on the graphical displays. JTWC used the TCLAPS and TLAPS predictions empirically during the last two forecast days of TC19P and throughout TC20S.
- b) The process has begun for FNMOC to retrieve the TCLAPS and TLAPS GRIB data and forward the data to JTWC.

RELATED PROJECTS

SAFA-Systematic Approach to TC Forecast Aid, an expert system designed to aid the forecaster in improved TC track forecasting.

ATCF-Automated Tropical Cyclone Forecast system, a forecasters workstation to produce and transmit tropical cyclone warnings to U.S. assets worldwide.

AIFS-Australian Integrated Forecast System, Tropical Cyclone Forecast Module Development, a forecaster workstation used at the Australian forecast offices to produce all warnings and forecasts.

PUBLICATIONS

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